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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/648,586	08/26/2003	Efren M. Lacap	408204	4089
30955	7590	02/05/2008		EXAMINER
LATHROP & GAGE LC				KERNs, KEVIN P
4845 PEARL EAST CIRCLE				
SUITE 300			ART UNIT	PAPER NUMBER
BOULDER, CO 80301			1793	
				MAIL DATE
				02/05/2008
				DELIVERY MODE
				PAPER

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/648,586
Filing Date: August 26, 2003
Appellant(s): LACAP ET AL.

MAILED
FEB 05 2008
GROUP 1700

Philip diZerega
For Appellants

EXAMINER'S ANSWER

This is in response to the appeal brief filed December 6, 2007 appealing from the Office action mailed February 16, 2007 and an Advisory action mailed July 5, 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellants' statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellants' statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,372,622	TAN ET AL.	4-2002
4,808,274	NGUYEN ET AL.	2-1989
6,977,396	SHEN ET AL.	12-2005
US 2003/0157789	TONG ET AL.	8-2003

Applicants' Admitted Prior Art (Figures 1 and 2; specification paragraphs [0002]-[0010])

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-11 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (AAPA) in view of US 6,372,622 (Tan) and US 4,808,274 (Nguyen).

AAPA teaches forming a socket on a first surface of a microchip, such that the socket has predetermined physical dimensions complementary to those of a microchip connection pad footprint occupied by at least one contact pad area on the microchip (fig. 2, item 29), the socket presenting a conductive base capable of bonding to solder; forming a solder layer (figure 2, items 3a, 3b, 3c where the layer comprises discrete units of solder balls) in substantially continuous contact with the conductive base (where the solder is in continuous contact with the conductive base) to place a solder bar (where the examiner interprets the solder ball to be a thin solder bar) in the socket and place the microchip in made-ready condition for installation (fig. 2, item 3a); wherein the microchip contains a silicon wafer and the step of forming the socket comprises depositing an adhesion layer onto the wafer, and depositing under-bump-metallization (UBM) material contacting the adhesion layer to complete formation of the conductive base (figure 2, items 4, 28, and 29); wherein the step of depositing the adhesion layer includes depositing a conductor selected from the group consisting of aluminum, nickel-vanadium, titanium, tungsten, and copper (specification, paragraph 7); wherein the step of depositing the UMB material includes depositing a conductor selected from at least one of titanium, tungsten, vanadium, tin, copper, aluminum, gold, silver, and lead (specification, paragraph 8); wherein the step of forming the socket includes the predetermined dimensions selected from the group consisting of rectangular, "E," "L,"

and "U" shapes (figure 2, side profile of item 29); wherein the step of forming the socket includes the physical dimensions selected from the group consisting of ring, square, and circular shapes (figure 2, top view of item 20a); wherein the step of forming the socket includes the physical dimensions being complementary to the solder bar having a planar rectilinear configuration (figure 2, side view of 20A); wherein the step of forming the socket includes the physical dimensions being complementary to the solder bar having a planar curvilinear configuration (figure 2, top view of 20a); wherein the step of forming the socket includes the physical dimensions being complementary to the solder bar having a planar curvilinear configuration (figure 2, item 3a); wherein the step of forming the socket further comprising a step of forming a passivation layer on substantially all of the first surface, exclusive of an area where the socket is located (figure 2, item 29); wherein the step of forming the passivation layer includes the steps of: applying one or more layers of passivation material to the entire first surface; and removing selected portions of the passivation material covering the area where the socket is to be located (figure 2, item 29); wherein the step of applying one or more layers of passivation material includes applying at least one layer selected from the group consisting of polysilicon, silicon dioxide, and benzocyclobutane (figure 2, item 28); where the corresponding circuit connection comprises one of a PCB, another chip, and a ceramic interposer (figure 2, items 26 and 1). Tan teaches the interchangeability between a solder ball and a solder rectangle (col. 4, ll. 20-30) and where the solder bonds to copper (figure 4, item 30). Nguyen teaches forming including depositing an adhesion layer via a screen printing process (col. 2, ll. 60-67).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the shape of the solder to utilize a rectangle in order to form a reliable electrical connection (see Tan col. 1, ll. 5-55); and to utilize copper as the UBM in order to effectively bond the solder to the substrate (see Tan col. 1, ll. 5-55) and further to modify the combined invention of Tan and AAPA to utilize screen printing in order to reduce the manufacturing costs (see Nguyen col. 2. l. 50 to col. 3. l. 25).

Claims 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA, Tan, and Nguyen as applied to claim 1 above, and further in view of US 6,977,396 (Shen). Shen teaches replacing solder balls with a solder bar (col. 6, ll. 30-40). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the solder to utilize a solder bar in order to increase the area of interconnect (see Shen col. 6, ll. 30-45).

Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA, Tan, and Nguyen as applied to claim 1 above and further in view of US 2003/0157789 (Tong). Tong teaches the adhesion layer can be applied by electroplating and screen printing and the UBM can be applied by sputtering (paragraphs 7 and 32). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the layers to utilize the claimed deposition process in order to ensure the layers are adequately formed (see Tong col. 10-32).

(10) Response to Argument

With regard to the appellants' remarks/arguments on pages 8-16 of the Appeal Brief, the appellants have provided arguments that address the 35 USC 103(a) rejections (in the (9) Grounds of Rejection section), as set forth in the following sections (hereafter Sections I, II, and III, as appellants set forth on page 7 of the brief):

- I) the 35 USC 103(a) rejections of claims 1-11 and 29 over the Applicants' Admitted Prior Art ("AAPA") in view of Tan et al. (US 6,372,622) and Nguyen (US 4,808,274) (pages 8-15 of brief);
- II) the 35 USC 103(a) rejections of claims 25-26 over the Applicants' Admitted Prior Art ("AAPA") in view of Tan et al. (US 6,372,622) and Nguyen (US 4,808,274), as applied to claim 1, and further in view of Shen et al. (US 6,977,396) (page 15 of brief); and
- III) the 35 USC 103(a) rejections of claim 28 over the Applicants' Admitted Prior Art ("AAPA") in view of Tan et al. (US 6,372,622) and Nguyen (US 4,808,274), as applied to claim 1, and further in view of Tong et al. (US 2003/0157789) (pages 15 and 16 of brief).

Regarding section I, subsection A (see pages 8-14 of the brief), the appellants' major argument is that independent claim 1 sets forth the limitation "solder bar", which allegedly would distinguish over "solder ball" of the prior art references AAPA and Tan

et al. (see pages 8 and 9 of the brief). For purposes of clarity, it is noted that the appellants have identified steps (a)-(d) of independent claim 1 throughout the brief, but these steps are not presented in their claim appendix.

In the 1st two full paragraphs on page 9 of the brief, the appellants argue that a "solder ball" is not a "solder bar", even when taken in view of the broadest reasonable interpretation of the term "bar". The examiner respectfully disagrees. During patent examination, the pending claims must be "given the broadest reasonable interpretation." Applicant always has the opportunity to amend the claims during prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once issued, will be interpreted more broadly than is justified. In re Prater, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969). In the instant case, while the appellants' definition is proper, it is the examiner's position that appellants' definition is not the broadest reasonable interpretation. The broadest reasonable interpretation would also apply to the appellants' argument in the 1st full paragraph on page 10 of the brief (accordingly, the Board is referred to the appellants' "used as a bar" versus "defined as a bar" argument in the last sentence of this paragraph of the brief). As stated previously (in the final rejection mailed February 16, 2007), DICTIONARY.COM defines "bar" as "a structural or mechanical member." In applying the Prater test by giving the claims the broadest reasonable interpretation, it is the examiner's position that the solder ball of the AAPA would be considered a solder bar because, *inter alia*, it is a mechanical member that assists in supporting the chip (4) on top of the PCB (1). Accordingly, step (b) of claim 1 (the "forming a solder bar..." step) is met by the AAPA.

Throughout pages 9 and 10 of the brief, the appellants argue that their definition of “solder bar” allegedly distinguishes over “solder balls” in various paragraphs throughout their specification. Although the 1st two lines of paragraph [0013] provide the most distinct “definition” of solder bars (in comparison to the remaining specification paragraphs in the sentence bridging pages 9 and 10 of the brief), it is important to note that the appellants argue in terms of the comparative openings or “sockets” (corresponding to “footprints”) provided by solder bars versus solder balls. Contrary to the appellants’ statement, this is not the same as providing a proper and distinguishing definition of “solder bar”. Furthermore, the appellants’ alleged “definition” is made even more non-specific in paragraph [0014] of the specification (for which the appellants did not even include and discuss in their listing of paragraphs in the sentence bridging pages 9 and 10 of the brief). Throughout paragraph [0014], the appellants provide several examples that do not limit the solder bars to a specific structure. In other words, the appellants never specifically state that solder bars are not solder balls, or otherwise cannot be “spherical”, but instead provide a plurality of various shapes without exclusion in paragraph [0014]. Moreover, the inconsistencies between paragraphs [0013] and [0014] of the appellants’ specification would result in a broad construction of “solder bars” that would encompass “solder balls”.

In the 2nd full paragraph on page 10 of the brief, the appellants also argue that Tan et al. do not disclose step (b) of claim 1 (the “forming a solder bar...” step). However, it is noted that Tan et al. also disclose solder “rectangles” and other shapes that depend upon the solder bump layout (see column 4, lines 19-28 -- reference

numbers 60 and 62 of Figures 6 and 7, which correspond to solder bumps -- clearly not solder balls, and would be complementary to the openings 42 (corresponding to "sockets" and "footprints") of Figure 4, as Tan et al. discuss in column 4, lines 15-27). Although the appellants cite a "substantially spherical" embodiment within the teachings of Tan et al. (see column 5, lines 6-15), they are citing an embodiment of solder balls while apparently ignoring the teachings of rectangular openings 42 corresponding to complementary rectangular solder bumps 60,62 (in Tan et al.; column 4, lines 15-27; and Figures 4, 6, and 7). It is noted that "The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned. They are part of the literature of the art, relevant for all they contain." In re Heck, 699 F.2d 1331, 1332-33, 216 USPQ 1038, 1039 (Fed. Cir. 1983) (quoting In re Lemelson, 397 F.2d 1006, 1009, 158 USPQ 275, 277 (CCPA 1968)). A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill in the art, including nonpreferred embodiments. Merck & Co. v. Biocraft Laboratories, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989). See also Celeritas Technologies Ltd. v. Rockwell International Corp., 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed. Cir. 1998). The court held that the prior art anticipated the claims even though it taught away from the claimed invention. "The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed.". In the instant case, it appears that the appellants have narrowly construed the teachings of Tan et al. As a result, this

argument is not deemed to overcome the combined teachings of the AAPA and Tan et al. under 35 USC 103(a).

In the paragraph bridging pages 10 and 11 of the brief, the appellants continue to argue that the "made-ready condition for installation" limitation (see step (b) of independent claim 1) is not taught or suggested in the prior art references. The examiner respectfully disagrees, as Figure 2 of the AAPA clearly shows that a microchip is "already installed". During patent examination, the pending claims must be "given the broadest reasonable interpretation." Applicant always has the opportunity to amend the claims during prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once issued, will be interpreted more broadly than is justified.

In re Prater, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969). In the instant case, the AAPA teaches the chip package for use in an electronic product (figure 2, items 4 and 1). It is the examiner's position that the preformed solder bar chip package "makes it ready" for installation in its ultimate use in the electronic product. Contrary to what the appellants state throughout the top half of page 11 of the brief, the "forming" (i.e. assembling) process would clearly takes place prior to the solder reflowing step, as discussed in paragraph [0007] of the AAPA. Furthermore, the appellants argue (in the last two paragraphs of page 11 of the brief) with regard to the "elongate axis parallel to a plane of the footprint" in step (c) of claim 1. However, it is noted that the "solder bars" of both the AAPA and Tan et al. each define three (x, y, z) axes, with one of these axes necessarily being parallel to the elongate axis of the footprint. Since the rectangular embodiment of Tan et al. (Figures 6 and 7) show the

elongate axis being parallel to the plane of the footprint, this argument is insufficient to overcome this aspect of the prior art rejections of independent claim 1. For these same reasons, the appellants' arguments addressing dependent claims 7 and 8 argued separately (see last paragraph on page 13 and the 1st paragraph of page 14 of the brief) fail to distinguish over the prior art rejections.

Regarding the appellants' arguments addressing dependent claim 4 (on page 12 of the brief), the deposited UBM (under-bump metallization) layer material is disclosed in paragraph [0008] of the AAPA. Furthermore, Tan et al. disclose a deposited barrier layer (UBM) material that comprises titanium tungsten etc. (see column 3, lines 40-53). As a result, the combination of the AAPA and Tan et al. is proper as a 35 USC 103(a) rejection in view of the limitations set forth in dependent claim 4, and thus a *prima facie* case of obviousness is established by this combination of prior art references.

Regarding the appellants' arguments addressing dependent claim 5 (on pages 12 and 13 of the brief), the appellants argue that the connection pad footprint does not have the claimed geometry. The examiner respectfully disagrees, as a "U" shape is clearly visible from Figure 2, as set forth at the top of page 13 of the brief. Furthermore, the limitation "U shape" of claim 5 is also subject to its broadest reasonable geometrical interpretation. During patent examination, the pending claims must be "given the broadest reasonable interpretation." Applicant always has the opportunity to amend the claims during prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once issued, will be interpreted more broadly than is justified.

In re Prater, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969). The

complementary interfacing regions (shown by the drawing in black ink to which the arrow is directed) form a "U" shape. As a result, this argument remains unpersuasive.

Regarding section I, subsection B (see pages 14 and 15 of the brief), the appellants argue that there is no reason to combine the prior art references. The examiner respectfully disagrees for the reasons set forth in the (9) Grounds of Rejection section, as the combination of the AAPA and Tan et al. suggests the "interchangeability between a solder ball and a solder rectangle", which is contrary to the appellants' statement in the 2nd paragraph of page 14 of the brief. As previously discussed above (in reference to the 2nd full paragraph on page 10 of the brief, Tan et al. specifically disclose solder "rectangles" and other shapes that depend upon the solder bump layout (see column 4, lines 19-28 -- reference numbers 60 and 62 of Figures 6 and 7, which correspond to solder bumps -- clearly not solder balls, and would be complementary to the openings 42 (corresponding to "sockets" and "footprints") of Figure 4, as Tan et al. discuss in column 4, lines 15-27). In response to the appellants' argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the shape of the solder to utilize a rectangle in order

to form a reliable electrical connection (see Tan col. 1, ll. 5-55); and to utilize copper as the UBM in order to effectively bond the solder to the substrate (see Tan col. 1, ll. 5-55), and further to modify the combined invention of Tan and AAPA to utilize screen printing, in order to reduce the manufacturing costs (see Nguyen col. 2. l. 50 to col. 3. l. 25). Finally, it is important to note that the teachings of screen printing of Nguyen, as well as its corresponding motivation to combine with the AAPA and Tan et al. under 35 USC 103(a), have not been disputed by the appellants throughout the Appeal Brief.

As a result, the combination of the AAPA, Tan et al., and Nguyen references renders obvious the claimed features of claims 1-11 and 29, and it is the examiner's position that the 35 USC 103(a) rejections of these claims be maintained.

Regarding section II (see page 15 of the brief), the appellants argue that the dimensional limitations of dependent claims 25 and 26 are not taught or suggest by the combination of prior art references, which also includes Shen et al. The examiner respectfully disagrees, as Shen et al. disclose that solder balls would be selectively replaced with solder bars to increase the area of the interconnect between the die and submount to dissipate more heat (see Shen et al.; column 6, lines 33-46; and Figures 3A-3D). The teachings of Shen et al. also suggest that increased contact area (corresponding to the claimed "width" in claims 25 and 26) would be dimensionally increased to be several times wider than its "depth" or "height", as increased "width" provides for increased heat dissipation by virtue of its greater contact area, and thus would increase the area of interconnect (see Shen et al.; column 6, lines 30-45).

As a result, the combination of the AAPA, Tan et al, Nguyen, and Shen et al. references renders obvious the claimed features of claims 25 and 26, and it is the examiner's position that the 35 USC 103(a) rejections of these claims be maintained.

Regarding section III (see pages 15 and 16 of the brief), the appellants argue that the step of "sputtering" the UBM material of dependent claim 28 is allegedly not disclosed or suggested by the combination of references, which also includes Tong et al. Importantly, it is noted that the appellants state (at the top of page 16) that "The reference to Tong is unintelligible because Tong contains fewer than 32 columns.". Actually, it is apparent from the 35 USC 103(a) rejections that the examiner had referred to "(paragraphs 7 and 32)" of Tong et al., and the term "col." in the cited "(see Tong col. 10-32)" should instead be "paragraph" (typographical error). Furthermore, paragraphs 7 and 32 (which are distinctly cited within the teachings of Tong et al. in the above 35 USC 103(a) rejections section) clearly disclose the sputtering of the UBM material, as claimed in claim 28. Contrary to the appellants' argument based allegedly upon a "conclusory statement" in the 35 USC 103(a) rejection of claim 28, the combination of Tong et al. with the other prior art references (the AAPA, Tan et al., and Nguyen) properly establishes a *prima facie* case of obviousness, as the sputtering deposition of the UBM material of Tong et al. is advantageous for enabling modification of the layers to utilize the claimed deposition process in order to ensure the layers are adequately formed.

As a result, the combination of the AAPA, Tan et al, Nguyen, and Tong et al. references renders obvious the claimed features of claim 28, and it is the examiner's position that the 35 USC 103(a) rejections of this claim be maintained.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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